PATENT SPECIFICATION

Application Date: Aug. 16, 1922. No. 22,310/22. **206,606**

Complete Left: May 16, 1923.

Complete Accepted: Nov. 15, 1923.

PROVISIONAL SPECIFICATION.

Improvements in Ball Bearings.

I, HENRY MARLES, Engineer, of 64, Mortimer Street, London, England, British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in ball bearings.

The object of my invention is to provide a ball bearing which shall be capable of sustaining both journal load and end thrust load with a minimum amount of friction when running, and which shall be capable of adjustment to ensure freedom from slackness when mounting the bearing, or for taking up any slackness that may occur as a result of wear. The bearing is also so constructed that its inner and outer members can be readily and conveniently separated from one another while the balls are retained upon the inner member.

The construction consists of an outer and inner bearing ring (commonly known as the cup and cone) accommodating between their opposing faces a plurality of rows or series of balls running in planes at right angles to the axis of the bearing. I prefer to employ two rows in each bearing although three or even more could be used. The rows of balls are arranged as near one another as convenient consistent with a reasonable amount of clearance to ensure that the balls and their retaining rings will not foul one another.

The outer ring or cup is substantially cylindrical on its outer periphery while the surface of its inner periphery is a constant taper cone, against which the balls bear and run. The inner ring or cone, which is usually bored to fit a shaft or axle, has ball tracks or grooves formed upon its outer periphery in which the two rows of balls are mounted independently of one another and in which position they are retained by suitable separate retaining rings. The balls all being the same size it follows that the tracks upon the inner cone which run parallel to one another, must be of different diameters so that both rows of balls running therein may contact with the inner coned periphery of the outer ring when the bearing is assembled. The method of adjustment of this bearing consists of axial displacement of the two bearing rings relatively to one another. So that to tighten the bearing the inner cone is set further into the outer cup.

The distinguishing and important feature of my invention lies in forming these ball tracks upon the inner ring or cone of such a shape that they will offer the greatest permissible supporting surface to the balls without causing excessive friction and wear. The sectional shape of these ball grooves takes the form of a curve, substantially circular, and of a curvature only slightly larger than that of the ball surface, so that theoretically each ball contacts with this track at a single point only and this point will be at the bottom of the tract of the said inner ring while the contact of each individual ball with the inner surface of the outer ring will be at a point directly opposite through the major axis of each ball.

This construction as applied to the multiple row adjustable ball bearing herein described ensures that the balls will at all times carry the load through their maximum diameter, whether the load be at right angles to the axis or parallel to it and each ball supporting its load at two points only, diametrically opposite to each other through the centre of the ball, a pure rolling of the balls will result and wear, both of balls and tracks, be avoided.

The retaining rings previously referred to may also act as separators for the balls. They preferably take the form of cylin-

[*Price* 1/-]

drical metal rings, either parallel or tapered to conform to the construction of the bearing, with spaced apertures through which the balls project radially inwardly and outwardly.

The diameter of the retaining ring is somewhat greater than the diameter of the centre of the ring of balls and the apertures therein somewhat smaller than the balls so that the retainer when in place holds the balls freely in their approximate running position upon the inner ring or cone.

The retaining ring may be placed in position by forcing or springing it over the balls, having first placed said balls in their track. To facilitate this the ball apertures may be cut through upon one side or edge of the retainer ring.

Dated this 16th day of August, 1922.

J. S. WITHERS & SPOONER,
Chartered Patent Agents,
Staple House, 51 & 52, Chancery Lane, London,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in Ball Bearings.

I, HENRY MARLES, Engineer, of 64, Mortimer Street, London, England, British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in ball bearings.

The object of my invention is to provide a self-contained ball bearing which shall be capable of sustaining both journal load and end thrust load with a minimum amount of friction when running, and which shall be capable of adjustment to ensure freedom from slackness when mounting the bearing, or for taking up any slackness that may occur as a result of wear. The bearing is also so constructed that its inner and outer members can be readily and conveniently separated from one another while the balls may be retained upon the inner member.

According to the present invention I provide as an article of manufacture a self-contained adjustable two-point contact ball bearing for sustaining both journal load and end thrust load, comprising an outer bearing ring having a cylindrical outer surface, an inner bearing-ring spaced therefrom and having a cylindrical inner surface and a plurality of rows or series of balls accommodated between their spaced opposing faces, the said rows or series of balls running on their one side on a tapering or conical surface, and on their other side in curved ball tracks or grooves of a curvature slightly larger than that of the ball surface, whereby contact of the balls with their contact surfaces of the inner and outer ring will be at points directly opposite through the major axis of each ball.

In order that the present invention may be clearly understood and more readily carried into effect it is hereinafter described with reference to the accompanying drawings, in which:—

Figure 1 is a sectional elevation of a preferred form of ball bearing constructed according to the present invention;

Figure 2 is a side elevation of said bearing;

Figure 3 is a side elevation of one of the sheet metal cages or separators;

Figure 4 is a sectional elevation showing a pair of these bearings applied to a front wheel hub of a motor road vehicle;

Figure 5 is a sectional elevation of a ball bearing substantially similar in construction to that shown in Figure 1 but showing a spring retaining ring in place of the sheet metal cages;

Figures 6, 7, 8 and 9 are partial sectional views illustrating slightly modified forms of ball bearings within the scope of the present invention;

Figure 10 is a sectional elevation of a modified form of bearing having three rows or series of balls, and

Figure 11 is an enlarged detail view showing more clearly the formation of the ball tracks and the consequent points of contacts of the balls.

As shown and in carrying the present invention into effect the construction consists of an outer and inner bearing ring a, b respectively (commonly known as the cup and cone) accommodating between their opposing faces a^1, b^1 a plurality of rows or series of balls c, c^1 running in planes at right angles to the axis of the bearing. I prefer to employ two rows in each bearing, as in Figures 1 to 9, although three or even more could be used, as shown by way of example in Figure 10. The rows of balls c c^1 are arranged as near one another as con-

venient consistent with a reasonable amount of clearance to ensure that the balls and their retaining rings d d^1 will not foul one another.

The outer ring or cup a is substantially cylindrical on its outer periphery a^2 while the surface a^1 of its inner periphery is a constant taper cone, against which the balls c c^1 bear and run. The inner ring or cone b, which is usually bored as at b^2 to fit a shaft or axle, has ball tracks or grooves b^3 b^4 formed upon its outer periphery in which the two rows of balls c c^1 are mounted independently of one another and in which position they are retained by suitable separate retaining rings such as those indicated at d d^1. The balls c c^1 all being the same size, it follows that the tracks b^3 b^4 upon the inner cone b which run parallel to one another, must be of different diameters so that both rows of balls c c^1 running therein may contact with the inner coned periphery a^1 of the outer ring a when the bearing is assembled. The method of adjustment of this bearing consists of axial displacement of the two bearing rings a b relatively to one another, so that to tighten the bearing the inner cone b is set further into the outer cup a. A distinguishing and important feature of my invention lies in forming these ball tracks b^3 b^4 upon the inner ring or cone b of such a shape that they will offer ample supporting surface to the balls c c^1 without causing excessive friction and wear. The sectional shape of these ball grooves b^3 b^4 takes the form of a curve, best shown in Figure 11, and which is substantially circular, and of a curvature only slightly larger than that of the ball surface, so that theoretically each ball contacts with this track at a single point only and this point will, as shown, be at the bottom of the track of the said inner ring b while the contact of each individual ball with the inner surface a^1 of the outer ring a will be at a point directly opposite through the major axis of each ball.

This construction as applied to the multiple row adjustable ball bearing herein described ensures that the balls c will at all times carry the load through their maximum diameter, whether the load be at right angles to the axis or parallel to it and each ball supporting its load at two points only, diametrically opposite to each other through the centre of the ball, a pure rolling of the balls will result and wear, both of balls and tracks, be avoided.

The retaining rings d d^1 previously referred to may also act as separators for the balls. They preferably take the form of cylindrical metal rings, shown in Figure 3, either parallel or tapered to conform to the construction of the bearing, with spaced apertures f through which the balls project radially inwardly and outwardly.

The diameter of the retaining ring d d^1 is somewhat greater than the diameter of the centre of the ring of balls c c^1 respectively and the apertures f therein somewhat smaller than the balls so that the retainer when in place holds the balls freely in their approximate running position upon the inner ring or cone b.

The retaining rings may be placed in position by forcing or springing them over the balls, having first placed said balls in their tracks. To facilitate this the ball apertures may, as in Figure 3, be cut through upon one side or edge of the retainer ring. In some cases the inner and outer rings may be kept together and therefore the balls may be retained in position by means of a spring retaining ring such as that shown at d^2 in Figure 5 or at d^3 in Figure 10.

In a slightly modified arrangement, instead of, as previously described, providing the outer ring with taper internal surface upon which both sets of balls are adapted to run, I may, as shown for instance in Figure 6, form one portion of the internal surface as a constant taper cone and the other portion thereof with a curved ball track a^3, or I may alternatively, as shown for instance in Figure 8, form both of the curved ball tracks or grooves in the outer ring a. The balls themselves in each row may be of the same size, as shown in the figures previously described, or they may be of different size as shown for instance in Figures 7 and 9, and here also the curved ball tracks may both be formed in the inner member b as shown in Figure 7, or in the outer member a as shown in Figure 9. Figure 10 illustrates a convenient arrangement in which three rows or series of balls, c, c^1 and c^2 are arranged in a single bearing. In this case all three curved ball tracks are formed in the inner member b, though they could equally well, of course, be provided in the outer member a, as will be readily understood.

I am aware of the Specification of prior British Letters Patent No. 2,557 of 1902 and No. 10,986 of 1896, and I make no claim to anything described therein, but:—

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. As an article of manufacture a self-contained, adjustable two-point contact

ball bearing for sustaining both journal load and end thrust load, comprising an outer bearing ring having a cylindrical outer surface, an inner bearing ring spaced therefrom and having a cylindrical inner surface and a plurality of rows or series of balls accommodated between their spaced opposing faces, the said rows or series of balls running on their one side on a tapering or conical surface, and on their other side in curved ball tracks or grooves of a curvature slightly larger than that of the ball surface, whereby contact of the balls with their contact surfaces of the inner and outer ring will be at points directly opposite through the major axis of each ball.

2. A self-contained adjustable two-point contact ball bearing according to Claim 1, in which the inner periphery of the outer ring or cup is a constant taper cone on which the rows or series of balls run, and in which the inner ring or cone has the ball tracks or grooves formed upon its outer periphery, rows of balls being held in place by suitable retaining cages.

3. A self-contained adjustable two-point contact ball bearing according to Claim 1, in which the curved ball tracks or grooves are formed in the inner periphery of the outer ring and in which the outer surface of the inner ring is formed as a constant taper cone.

4. A self-contained, adjustable two-point contact ball bearing according to Claim 1, in which the curved ball tracks or grooves are formed in both the inner and outer bearing rings, so that one row or series of balls runs in a curved ball track or groove in the inner member, and on a tapered conical surface in the outer member, and so that another row or series of balls runs on a curved ball track or groove in the outer member and on a conical surface on the inner member.

5. A self-contained, adjustable two-point ball bearing according to any of the preceding claims, in which the balls of the rows are of different diameter, the curved ball tracks or grooves therefor being formed in either the inner or outer ring.

6. A self-contained adjustable two-point contact ball bearing according to any of the preceding claims, having three or more rows or series of balls, substantially as described.

7. The improved self-contained, adjustable two-point contact ball bearing, substantially as described with reference to Figures 1, 2 and 3, or to Figure 5, or to Figure 6, or to Figure 7, or to Figure 8, or to Figure 9, or to Figure 10 of the accompanying drawings.

Dated this 16th day of May, 1923.

J. S. WITHERS & SPOONER,
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London,
Agents for the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1923.

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Fig. 1.

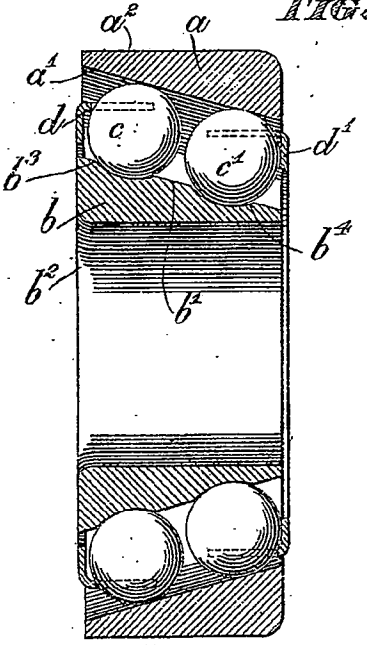


Fig. 2.

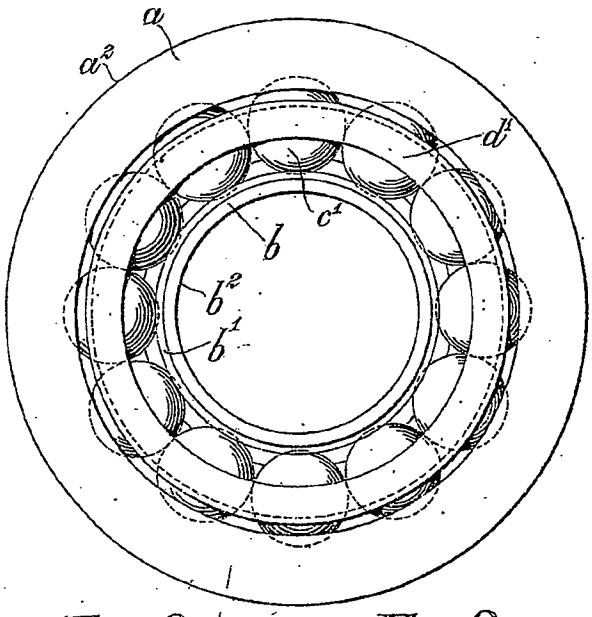


Fig. 5.

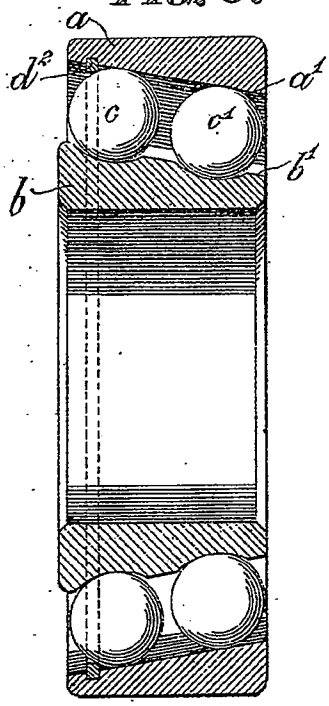


Fig. 6.

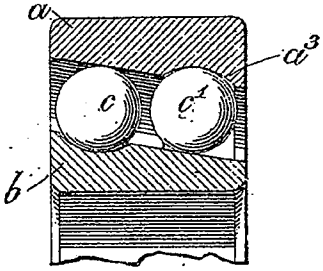


Fig. 8.

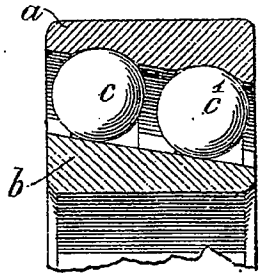


Fig. 7.

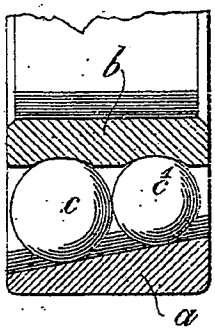


Fig. 9.

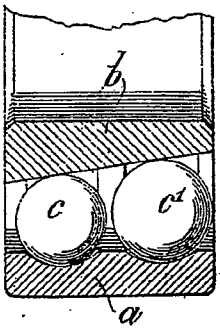


Fig. 3.

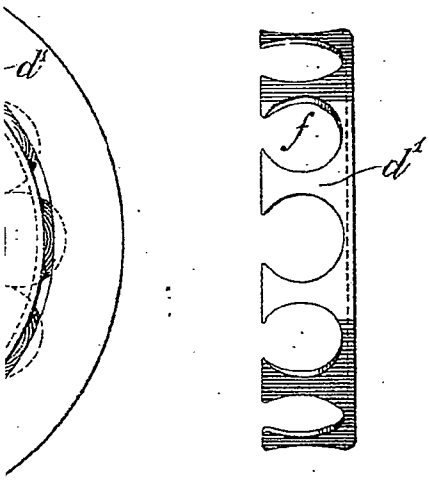
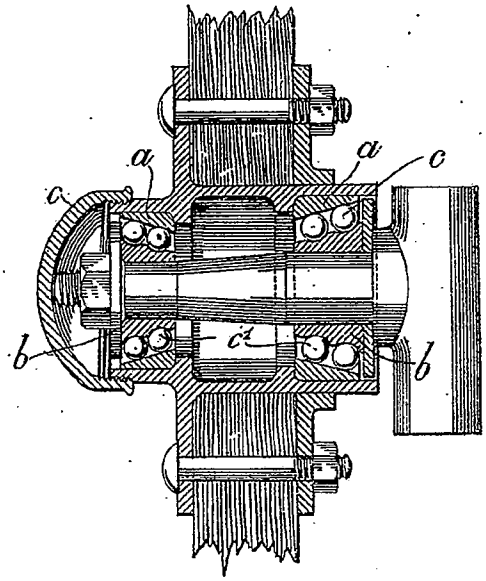


Fig. 4.



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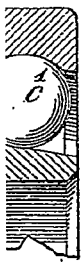

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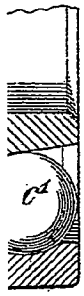

Fig. 10.

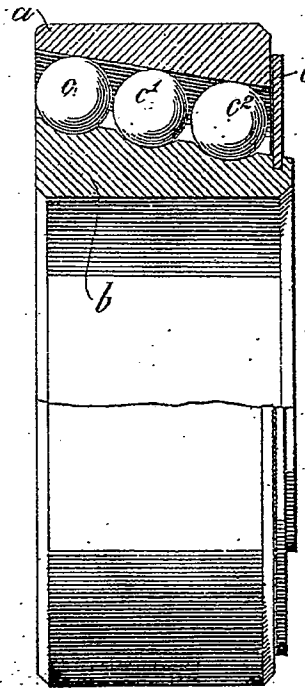

Fig. 11.

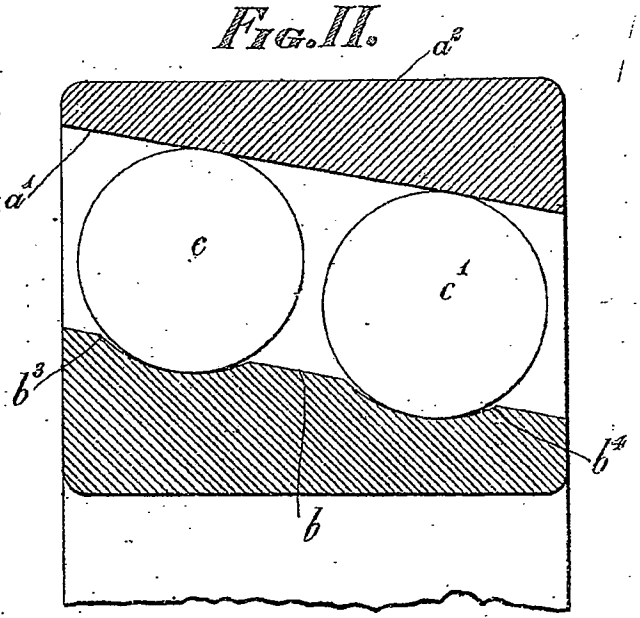

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FIG. 1.

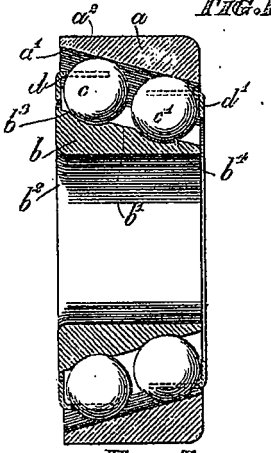
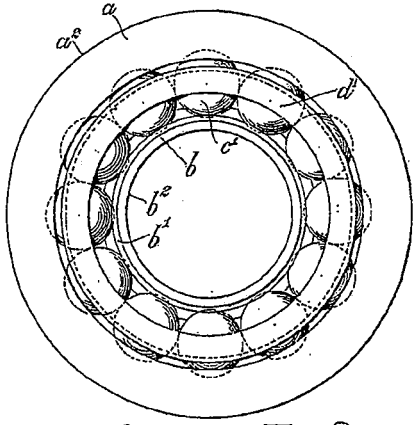


FIG. 2.



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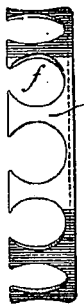

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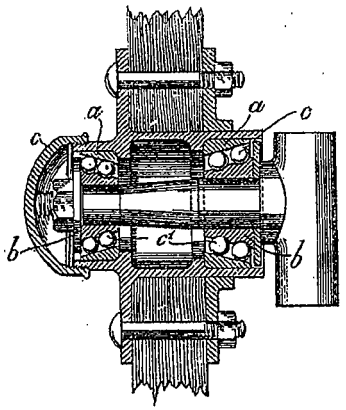
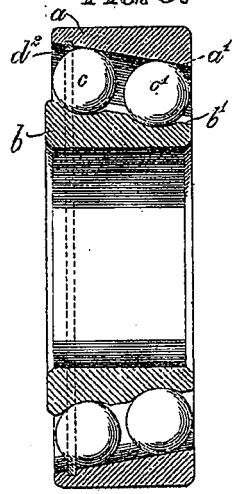


FIG. 5.



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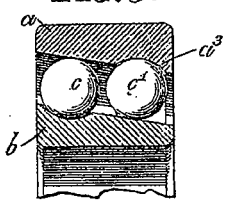


FIG. 8.

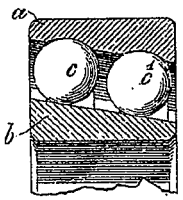
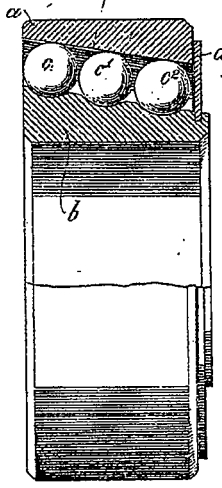


FIG. 10.



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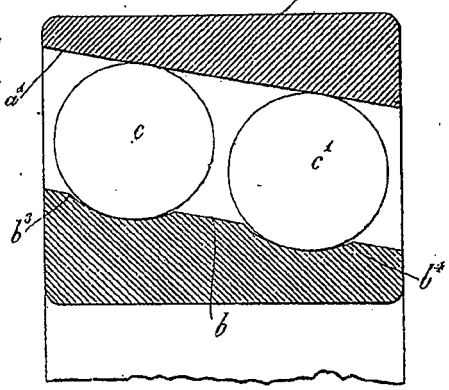

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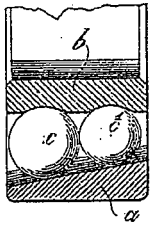
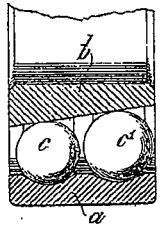


FIG. 9.



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